BY MABEL A. SMITH

Seasonal Adjustment of Economic Time Series

Significance and Uses

SEASONALLY adjusted series are being used increasingly to detect basic short-run changes in economic and business conditions, with resulting emphasis on refining the methods used for adjusting economic series for seasonal variations. An awareness of the significance and uses of adjusted series and of the multiplicity of problems involved in adjustment techniques, and in the interpretation of the series, is especially important at this time when seasonally adjusted data are being more widely utilized as guides in policy making by both government and business.

This article covers briefly the variety of seasonal patterns, the relation of seasonal variations to longer-term movements, and illustrates some of the problems of measurement. It suggests a few uses of seasonally adjusted data as guides in business forecasting and for other purposes.

Need for adjustment

An important use of economic or business series is to determine the stage in the business cycle, or the position in relation to the long-term growth of the nation, industry, or business involved. For this purpose, the problem resolves itself into separating cyclical and secular forces from other types of influences, particularly those due to seasonal factors. Having dependable separation of these various components is often of critical importance in spotting turning points in the cycle.

In recent months, for example, government officials and others have been engaged in determining the "true" course of our economy—whether and to what extent it is still moving upward, or is tending to level off, or whether it has already passed its peak. In part such analysis must rely on the use of seasonally adjusted economic data, which are designed to reveal whether actual changes in business over recent months have been larger or smaller than normal seasonal movements.

Seasonally adjusted data are also essential guides to businessmen in making sound decisions concerning short-run operations. These include determinations as to price and inventory policy, material purchases, and workers needed, and are usually based upon forecasts of the volume of business in the months ahead, often for the nation as a whole as well as for the individual company.

For example, July retail sales at department stores decreased 12 percent from June with the result that these retailers had $160 million less business than in June. Does this mean that consumer buying at department stores had faltered in July? On the contrary, retailers know that July is normally a slack month because of vacations and other reasons. Being aware of this, they often gage their performance with that of the same period the year before. The use of such year-to-year comparisons is quite common among businessmen and others. There appears to be implicit in this practice the belief that if this year's figure is above last year's, the situation is favorable, and vice versa. While this procedure has the advantage of simplicity, it may easily result in erroneous conclusions in evaluating the current tendency.

Let us go back to the department store illustration. July sales were 9 percent above July of last year. But using this same type of comparison, June was also higher than the previous June, and the same was true for the earlier months of this year. For more than a year the economy has been recovering from the 1961 recession low—incomes have been rising, and in many areas consumers have tended to increase their purchases in line with their income gains. The year-to-year advances do not provide a measure as to whether department stores were participating in the recovery, and to what extent. Such year-to-year comparisons can indicate only what has happened *over* but not *during* the intervening 12 months; they do not show whether the overall trend has altered.

How, then, can the store executive really judge the "true" course of his sales? The answer is that specific methods have been developed for appraising the basic movement of a series from one period within a year to another. In the case of department stores, the use of these techniques indicates that the decline in their average daily sales from June to July due to seasonal influences alone has changed gradually from 16 to 12 percent over the past 10 years. Thus, if such sales had decreased 12 percent this July, it would have been in line with seasonal expectations. Instead, the actual decline in their average daily sales was 9 percent.[1] This means therefore that department stores experienced an improvement in July sales over June—a rise of 3 percent—even though the actual dollar volume was less than in June.

Anatomy of an economic time series

The various components which together result in the observable overall

1. The difference between this figure and the 12 percent shown for the actual monthly sales is accounted for by variations in the number of selling days.

movement of an economic time series are the long-term trend, the cyclical fluctuations, the seasonal variations, and the random or irregular nonrecurrent influences.

The trend is the basic growth or decline over a long-run period. The cycle consists of shorter run movements characterized by alternating periods of expansion and contraction which may last several years. The seasonal consists of movements within the year which follow a more or less regular pattern and come about because of occurrences usually associated with the seasons of the year; they reflect primarily changes in weather conditions, trade practices, and consumer buying habits. For example, each year sales of gasoline service stations rise steadily to June, continue high in July and August reflecting vacation trips, and then fall off for the remainder of the year. Most economic series contain significant seasonal fluctuations, but some contain virtually none—stock prices, for example.

The irregular fluctuations are those that remain after the three factors mentioned have been taken into account. They may be variations of a random nature, or reflect exceptional events, such as strikes, wars, and unusual weather. Normal weather influences are taken into account by the seasonal adjustment.

The four kinds of movements described vary in importance from one series to another. The outstanding feature of series such as the production of antibiotics, synthetic fibers, and frozen foods is their strong uptrend. Durable goods, on the other hand, are generally characterized by wide cyclical fluctuations. Other series, such as department store sales, do not show such sharp trends or pronounced cyclical movements but exhibit wide seasonal fluctuations. The irregular movements are very large in the case of manufacturers' purchased material inventories, but very small in grocery store sales.

The most common representation of a time series (E) in terms of the aforementioned components is:

$$E=T\times C\times S\times I^{1a}$$

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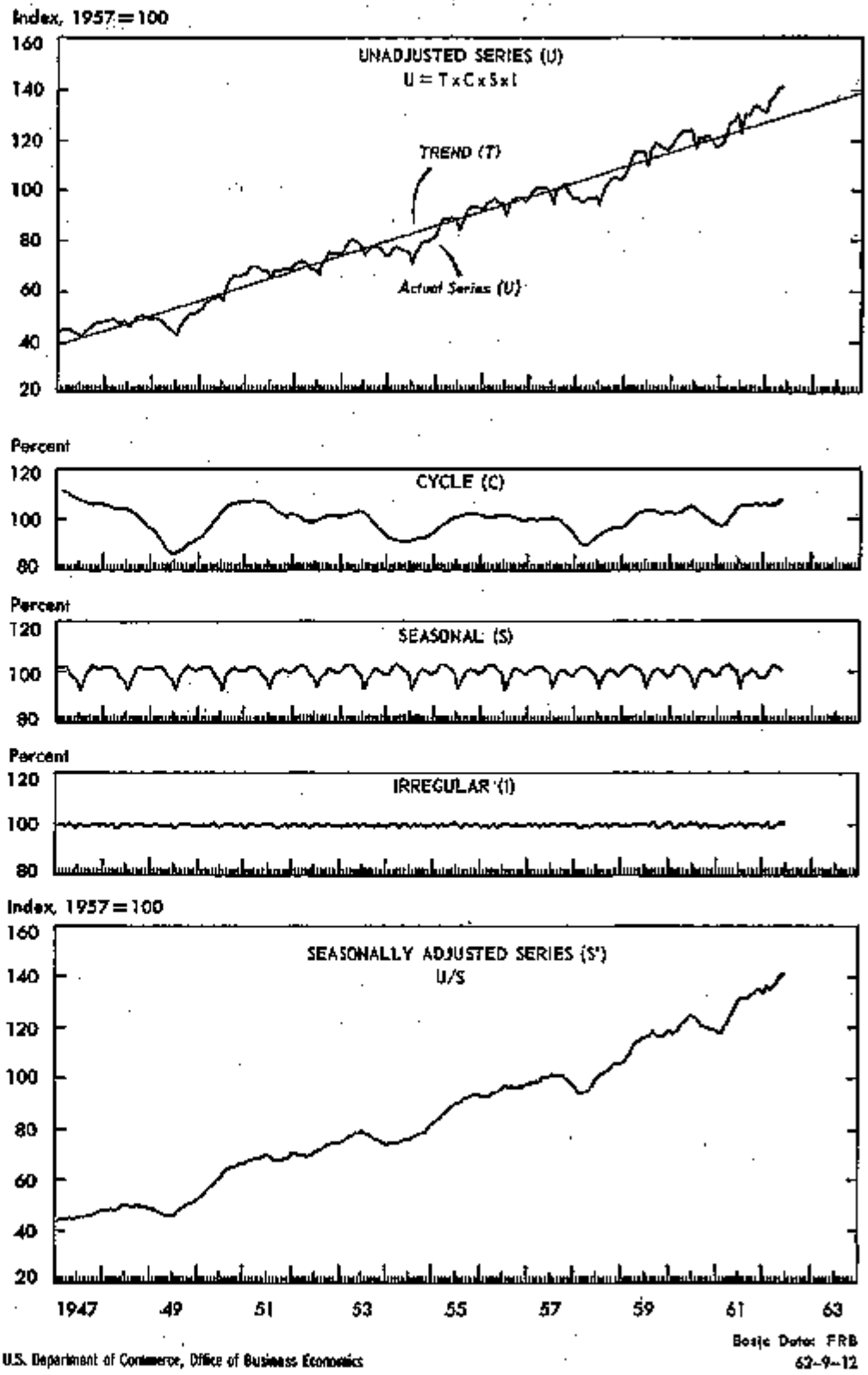
THE ANATOMY OF A TIME SERIES

PRODUCTION OF CHEMICALS AND RELATED PRODUCTS



U.S. Department of Commerce, Office of Business Economics

Basic Data: FRB
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It is clear from this relation that in order to obtain the seasonal factors (S), it is necessary to estimate the product of T and C (often called the "trend-cycle"), and then to eliminate the irregular element I by averaging. The statistical methods by which this is accomplished will be touched on later.

1a. A less common formulation is $E=T+C+S+I$, generally used when the seasonal movement falls close to zero in one or more months.

It is also apparent from the first equation that to remove the seasonal element from the original unadjusted series, all that is needed is to divide E by S.

$$S' = E/S = T \times C \times I$$

Thus, the seasonally adjusted series (S') consists of the product of trend, cycle, and irregular elements, the seasonal factor having been removed.

The above formulation is illustrated in the chart on page 25, which shows the composition of an actual time series, namely, monthly production of chemicals and related products, over the last 15 years. Note the irregularities in the pattern of actual production in the first panel. The straight line drawn through this curve represents the long-term trend, which in this case reflects an average rate of growth of 7½ percent per year. The next panel of the chart shows the wave-like cyclical fluctuations of this series. The product of the trend and cyclical movements comprises the trend-cycle component of the original data.

The middle line reveals the fairly regular seasonal movements recurring within each year. These range from an average high of 103 percent of the annual average in March to an average low of 94 percent in July—a spread of nearly 10 percent. The next to the bottom panel shows the random changes, not due to trend, cycle, or seasonal factors. It is apparent that in the case of chemicals production the random or "residual" fluctuations are very small.

The product of the monthly readings from the trend and the three middle lines yields the actual production shown in the top curve. As indicated earlier, when the actual value for each month is divided by the corresponding seasonal factor shown in the third panel, the result represents the seasonally adjusted series shown by the bottom line on the chart. Note the regularity of the monthly fluctuations here since they now reflect only the trend, cycle, and, in this case, relatively minor random influences.

As the chart shows, the seasonal variations contribute greatly to the monthly fluctuations. Over the 15-year period the average absolute month-to-month change in chemicals production attributable to the seasonal factor is 1.9 percent, whereas for the cycle it amounts to 0.8 percent, and for the trend and irregular movements each 0.6 percent.

Encompassed within the definition of seasonal are variations between months due to differences in the number and relative importance of working or selling days. Variations in the length of the calendar month may be taken care of in the regular seasonal adjustment, but the basic method does not take into account differences in the number of days a business operates—due, for example, to a varying number of Sundays in a month—or variations in the relative importance of the various days of the week in that particular area.

In the case of food stores, where a large part of the buying is done in the latter part of the week, even though 2 months may have the same number of shopping days, the one having an extra Saturday, for example, will generally record larger sales. In seasonally adjusting series of this type, the data are first converted to an average daily or monthly basis, in the computation of which the days of the week are weighted according to their relative importance.

Changes in consumer habits or other conditions often result in a shift over a period of time in the seasonal factor for a particular month or quarter. For example, in the past when cars had no heaters and when roads were not usually cleared of snows, the use of cars and the consumption of gasoline declined sharply in the winter months. As these conditions were modified, and dependence on private transportation increased, the seasonal influence became much less pronounced. Thus, an improvement in gasoline sales for the same month in successive years may merely reflect a shift in the normal seasonal toward increasing use of vehicles at that time of the year.

A second illustration of the changing importance of certain months over a period of years may be found in department store sales. At the present time nearly 180 percent of the average monthly sales for the year are made in December; 15 years ago the percentage was 165. Offsetting the December gain, February and March [2] sales have declined from 80 and 93 percent, respectively, to 73 and 85 percent of the annual average. Thus, Christmas buying has become a more and more important part of department store business.

Finally, tax collections by the Federal government involve a seasonal pattern which is determined by law. At times the law has been changed as to the due dates of taxes and this has resulted in a shift in the seasonal pattern.

Variety of seasonal patterns

The interest in seasonal movements is highlighted by the fact that in our economic activities there is a wide variety of seasonal patterns, ranging from cases where there appears to be no seasonal variation at all to those where the seasonal effect in a particular month is many times the average for the year. In this section various types of seasonal patterns will be presented.

The chart on page 27 shows the wide variety of seasonal patterns in retail trade. The seasonal factors presented here are those derived for 1962, in order of increasing variability. The retail trade area encompasses practically all types of seasonal movements which commonly occur.

Note that stores handling primarily staples experience little seasonal changes in sales—these include grocery and other food stores and, except for Christmas gift buying, drug stores. It should be noted that even though the seasonal movement for total grocery store sales is small, for many individual products there are pronounced waves of buying at different times of the year. This is particularly true of seasonal items such as fresh fruits and vegetables, where the supply may range from many times the annual average in one part of the year to zero in another. Apparently when these foods are not available or are in small supply, consumers shift their buying to the frozen or canned version or to other more plentiful items, thus minimizing the seasonal movements in total grocery store sales.

2. Comparison of the March figures for 1947 and 1961, years having approximately the same Easter date, indicates a similar decline in importance.

The influence of vacation travel during the summer months is apparent in the seasonal patterns for gasoline service stations and for eating and drinking places. The marked effect of Christmas buying shows up in the seasonals for general merchandise, apparel, and furniture and appliance stores. In addition, the effect of Easter buying, which occurred late in April this year, is depicted strikingly in the apparel store sales seasonal, and to a lesser extent in that for general merchandise stores. Due to the influence of the weather on construction activities, the pattern for lumber, building materials, and hardware stores shows very low sales in the winter months. Automotive store sales are typically high in the spring and then decline until the new models appear on the market in the fall.

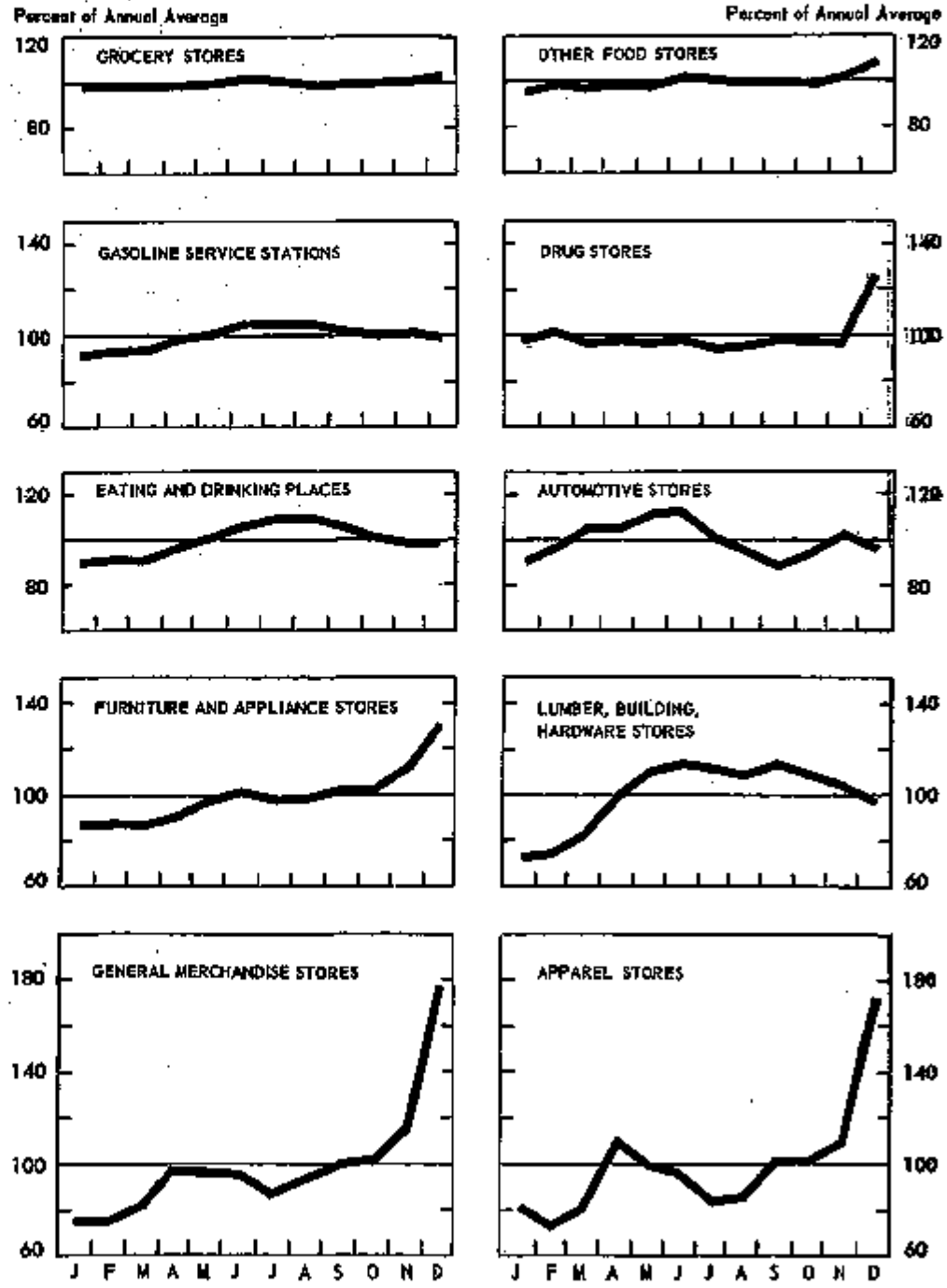
A similar wide variety of seasonal patterns exists in industrial production. This becomes apparent when the series are classified according to the average absolute departure of their monthly seasonal factors from the yearly average; this may be used as a measure of the "amount" of seasonal. If we consider an average departure between 5 and 10 percent as indicative of a moderate seasonal, then about ⅓ of the production series [3] fall into this category. This includes most fabricated metals, furniture, lumber, drugs, canning, and leather industries.

Pronounced seasonals (more than 10 percent average deviation) are indicated for ⅓ of the series, namely, the apparel, distilling, agricultural machinery, tin can, and metal mining industries. The remaining half which have small seasonal patterns (less than 5 percent deviation) includes the food, paper, petroleum, rubber, chemicals, primary metals, utilities, and most nonagricultural machinery industries.

Perhaps the most pronounced seasonals occur in the production and marketing of agricultural products. Here the data are far from complete, and the seasonals are generally more difficult to determine. In many cases marketings are bunched in only a few months, and the period may vary from one year to the next due to the vicissitudes of the weather. Currants are an extreme example where almost the entire supply is marketed in the month of July. The marketing of potatoes, on the other hand, is spread rather evenly over the entire year.

Certain of the production series have their parallels at the retail level. As would be expected, where the parallel is close the seasonal factors are generally similar, except for a lag. In apparel, for example, manufacturers' shipments reach a spring peak one month earlier than sales of retail apparel stores. The extremely high Christmas sales concen-

SEASONAL PATTERNS IN RETAIL SALES



Note: 1962 seasonal factors including trading day adjustments

Basic Data: Census

U.S. Department of Commerce, Office of Business Economics

62-9-12

3. Since many components of the monthly industrial production index are based on manhours, these departures were based on manufacturers' sales plus mining and utilities. Employment and manhours generally show much smaller seasonal fluctuations than production.

trated to a large extent in a single month at retail are spread over the several preceding months at the production level.

While it might be expected "a priori" that the seasonal patterns for employment and production in the same industry would be similar, this is not usually the case. In general, employment has smaller monthly fluctuations than output, primarily because of changes in the number of hours worked and in productivity. Also, recognizing that seasonal movements do occur and are temporary, producers and distributors tend to maintain their workers in slack periods and to lengthen hours of work during busy periods. In fact, while only 9, or about one-fifth, of the 48 industries examined have production seasonals with an average absolute monthly deviation of less than 4 percent, all but 2 of the 29 available employment series fall into this category. The two industries where the employment seasonal is relatively large are contract construction and tobacco manufacture.

Moving seasonals

A feature of certain series is a change in the contour of the seasonal over the years, resulting in moving seasonal factors. Such modifications in contour arise mainly from gradual shifts in the basic conditions underlying the seasonal movements, such as changes in consumer habits and tastes. Moving seasonals in sales of department stores and gasoline service stations have already been cited. In the latter case the result has been a dampening in the seasonal amplitude from the prewar to the postwar period.

Another example is given in the adjacent chart, which shows the monthly movement of Portland cement production from 1948 to the present. Here there was a gradual widening of the seasonal through 1957, after which the amplitude stabilized. Apparently this change in amplitude was a function of the capacity available during the postwar period. In relation to demand, capacity was inadequate in the early postwar years, and this tended to limit the production rise in the months of high consumption, with the consequence that some demand spilled over into the following normally slack period. After capacity was increased, the normal seasonal pattern prevailed. Along with the change in amplitude there is a striking regularity in the seasonal pattern. A large part of this product is utilized in such seasonally variable outdoor operations as the construction of roads and buildings.

Relation of seasonal to longer run movements

It is of interest to examine the character of the seasonals in relation to longer term movements. Do industries experiencing rapid growth exhibit less pronounced seasonals? Is there any relation between the amplitude of the cycle and that of the seasonal? Do industries experience a shift in seasonal as the economy approaches full employment? No exhaustive treatment is proposed here; rather, these questions will be examined on a case study basis.

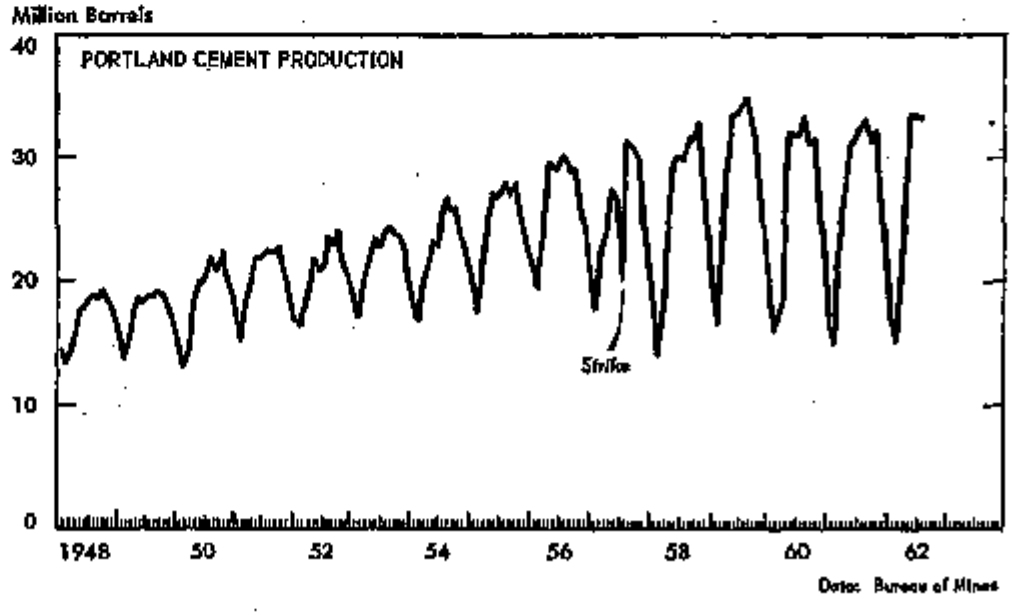
While many examples can be given to show that a wide variety of seasonal patterns are associated with growth products, two differing cases will be presented—passenger air travel and the use of electricity. Over the past decade the average rate of growth for passenger revenues of air carriers has been 12½ percent per year, while sales of electric power have increased at an average annual rate of 8½ percent. It may be seen from the chart on page 29, however, that a sharp uptrend in a series does not necessarily have a correlation with the degree of seasonal amplitude. Electric power sales, on a quarterly basis, have rarely deviated more than 3 percent from the annual average.[3a] Passenger air revenues, on the other hand, have fallen as much as 10 percent below the annual average in the first quarter of the year and have exceeded it by 8 percent in the summer quarter.

The second question—whether there is any relation between the amplitude of the cycle and the amount of the seasonal swing—is again illustrated by a few representative cases. The chart on page 30 shows the annual movement of four economic series over the postwar period and their monthly movement during 1961.[4] Both residential construction activity and sales of the primary nonferrous metals industry, which are shown in the upper half of the chart, have wide cyclical swings, but the amplitude of their seasonals is quite different. Residential construction activity is usually very low in the winter and high in the period from May to October. In the case of the nonfer-

3a. Since passenger revenues of air carriers are not available monthly, both series are shown quarterly. The average deviation for electric power sales, on a monthly basis, is close to 5 percent.

4. Examination of a series of years suggests that in each case the 1961 monthly fluctuations reflect for the most part the seasonal pattern.

EXAMPLE OF INCREASING SEASONAL SWING



Data: Bureau of Mines

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rous metals, however, the monthly movement is within a relatively narrow range around the annual average.

A corresponding dissimilarity is apparent between cement production and grocery store sales, two areas which show little cyclical effect. These series are shown in the lower half of the chart. As indicated earlier, cement production has a pronounced seasonal, while grocery store sales show very little monthly fluctuation. In fact, if the monthly sales shown in the chart were corrected for variations in trading days, even these small fluctuations would largely disappear.

It is clear from this chart that examples of all possible combinations of degree of cyclical swing and amount of seasonal fluctuation could be obtained. Items which have wide cyclical swings may have little or no seasonal fluctuations or very marked seasonals, and the same is true for items with small cyclical swings.

The seasonal patterns of these four cases and those associated with the growth products reflect the fact that the degree of seasonal variability is inherently dependent primarily on the habits, tastes, and customary practices of the people of a country. This does not mean that the seasonal behavior is unalterable apart from these factors. On the contrary, it is likely that changes may be developing as a result of special factors such as the reduced fares announced by airlines to encourage greater travel abroad in the "off-season" period, and the reduced rates and increasing attractions offered by resort establishments to stabilize their seasonal business.

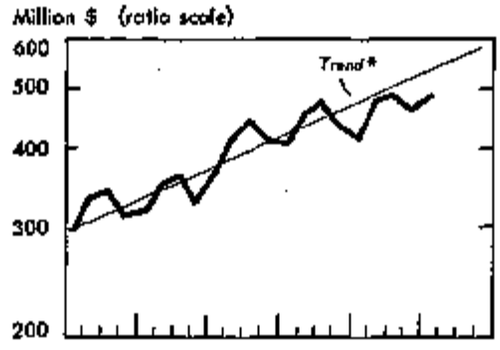
Finally, a word on whether seasonal patterns tend to be modified in periods when the economy is operating at full resource use. Here our experience is rather limited since there have been few extended periods during which the economy has been at full employment. However, there is no evidence of widespread shifts in seasonal patterns in the postwar full employment years from those prevailing in years of cyclical change. Obviously, when certain industries are under forced draft—as the iron and steel industry during the war period—seasonal fluctuations disappear. But it remains a question whether the achievement of sustained full employment would by itself tend to substantially modify seasonal patterns.

Determining the seasonal factors

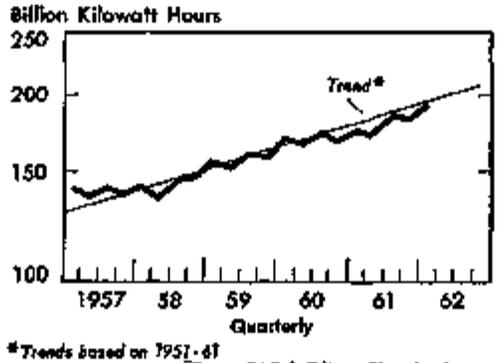
Since so much depends on seasonally adjusted data, two questions are often raised: How reliable are the seasonals? Are the seasonal factors unique? A brief consideration of the methods of seasonal adjustment will provide a partial answer to these questions.

SEASONAL SWINGS AMONG GROWTH PRODUCTS

AIRLINE PASSENGER REVENUES Have Wide Seasonal Fluctuations . . .



and ELECTRIC POWER SALES Show Little Seasonal Movement



*Trends based on 1951-61

Data: CAB & Edison Elec. Institute.

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There are many different methods of adjusting time series for seasonal variations. All, however, are based on the fundamental idea that seasonal fluctuations can be measured and separated from the trend, cyclical, and irregular variations. Two basic determinations must be made in the process of deriving seasonal factors. First, it is necessary to obtain the best possible trend-cycle for the series. Second, it is necessary to determine for each month the average deviation of the original series from this trend-cycle.

The most commonly used procedure for accomplishing this is the ratio-to-moving-average method.[5] In this approach an estimate of the trend-cycle is first obtained by the use of a moving average which combines 12 successive monthly figures (or four quarterly ones), thereby eliminating the seasonal element, or by some modification or refinement of this step. Division of the original data by this moving average yields a series of so-called "seasonal-irregular ratios."

An estimate of the seasonal factors is then secured by averaging these ratios, month by month, or quarter by quarter, and assuming that the irregular factor will be "averaged out" in the process. Finally, the original observations are seasonally adjusted by dividing them by the seasonal factors. The upper part of the chart on page 31 illustrates the application of this method to travel expenditures in foreign countries by U.S. residents. For purposes of comparison with a second method, only first quarter data are shown.

Important modifications and improvements introduced in the ratio-to-moving-average method have included smoother and more flexible trend-cycle curves and the use of moving seasonals. An electronic computer program,[6] which utilizes a refined version of the moving-average method, has also been developed and tested, and improvements are continually being introduced. A full run of this program for a ten-year monthly series requires only minutes on a large-scale computer. This type of program, however, should be regarded as an economical preliminary to professional analysis rather than as a substitute for it. Professional review and special adjustments for certain series are still necessary and appropriate. Besides other advantages, the development of electronic computer programs has served to stimulate exploration and discussion of seasonal adjustment and has helped to widen the use of seasonally adjusted data.

An interesting and comparatively new approach to seasonal adjustment

5. Detailed descriptions of the various methods may be found in any standard statistics book.

6. A detailed description may be found in "Electronic Computers and Business Indicators," J. Shiskin, NBER Occasional Paper 57.

is the use of a regression technique.[7] Basically, this procedure involves deriving a relationship (usually a linear regression) for each month, or quarter, between the original data (X) and the 12-month moving average or some refinement of it (Y).

The lower two panels of the chart show the use of this method. Each point represents a year, the X-reading corresponding to the actual first quarter value that year and the Y-reading corresponding to the 12-month moving average appropriate to that value. A similar chart would be used for each of the other quarters. As a new quarterly figure becomes available, it is located on the X-axis (horizontal) and the corresponding Y-value (vertical) on the regression line is determined and used as the seasonally adjusted value. In this case the adjusted data derived by the two methods are very close.

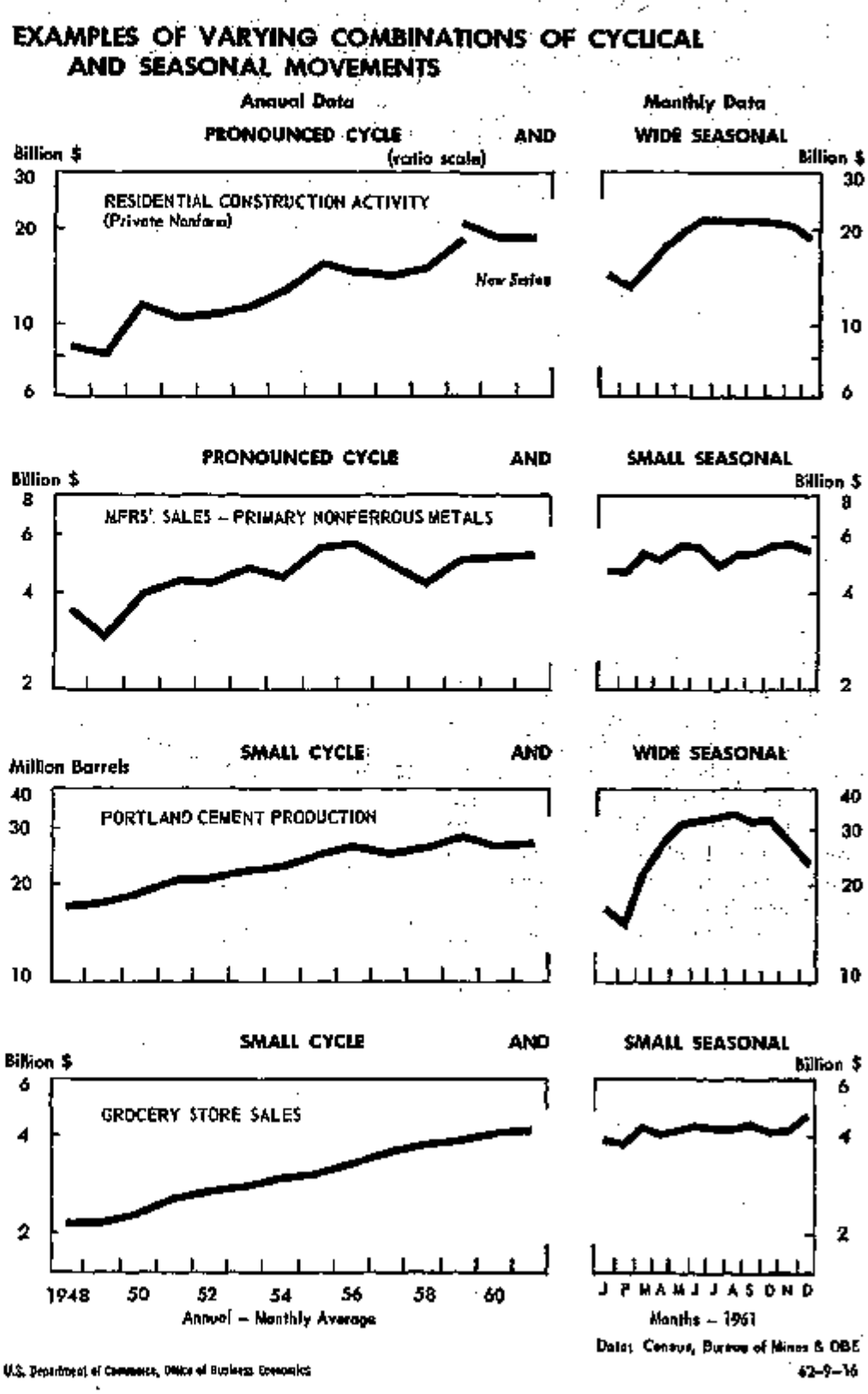
Some obvious differences between the two approaches are that the regression procedure by-passes the derivation of seasonal factors, yielding the seasonally adjusted series directly, and makes unnecessary the extrapolation of the trend-cycle curve for the most recent period, which is used in the ratio-to-moving-average method.

The ultimate test of the acceptability of a technique is that it yields a seasonally adjusted series which for any given month does not show changes from the preceding month in the same direction in most years. Despite the great progress that has been made, however, there are cases where it is extremely difficult to isolate the seasonal element, and where the results of the available seasonal adjustment techniques are far from satisfactory. These problem cases have sometimes led to serious questioning of the findings obtained by the use of "standard" methods. The reliability of a seasonal adjustment becomes particularly important when it is necessary to decide whether or not a turning point in a series has been reached.

A particularly difficult month to seasonally adjust is July due to such varying factors as vacations, letdown in employment opportunities and in auto and steel production. In assessing the "true" seasonally adjusted movement in this period, it is often prudent to use the averages of the seasonally adjusted figure for July with the preceding and following months as guides to iron out the peculiarities of these summer months.

Special problems in seasonal adjustment

Preliminary adjustments are often necessary before proceeding with the seasonal adjustment of a series. The



7. See "Application of the Regression Method to the Analysis of Statistical Time Series," Deutsche Bundesbank Frankfurt, Federal Republic of Germany, 1959. Some preliminary work along these lines was done earlier.

fact that a holiday or other regular annual event may come on a different day of the month, or even in a different month, from one year to the next is in effect a seasonal influence, but a special preliminary adjustment is necessary, as for differences in working days, which was discussed earlier.

Two obvious instances where preliminary adjustment is needed are for the varying dates of the introduction of new automobile models from year to year, which influences the seasonal patterns of both production and sales, and for the changing date of Easter with its stimulating effect on either March or April sales of clothing.

The accompanying table shows the percentage distribution of apparel store sales by months for 1961 when Easter occurred on April 2, and for 1957 when it was on April 21, so that the bulk of the clothing buying occurred in a different month in these 2 years. Note the heavier sales just before the holiday in each case. A fairly adequate method has been developed for handling the effect of the shifting date of Easter. In the case of autos, on the other hand, the effect is not so clear, and at present the adjustment depends to a larger extent on the judgment of the analyst.

The question sometimes arises as to whether a more satisfactory total can be obtained by adjusting the aggregate series itself, or by combining its seasonally adjusted components. Recent investigation [8] has shown that the results do not differ significantly provided that similar techniques and procedures have been used. One advantage of seasonally adjusting the components separately is that it permits refinements which cannot be made in the total series, such as appropriate corrections for calendar variations and unusual influences. The direct adjustment of the aggregate, however, may be used as a check on the sum of the components, and such a comparison may reveal areas where further study of the data is desirable.

Another problem is the adjustment of series which are available for only short periods of time or with gaps in the data over periods. Also, of critical importance is the determination of reliable seasonal factors for the current year, since changes in seasonals typically develop and the factors for the recent period must be under constant review.

Uses of seasonals by business

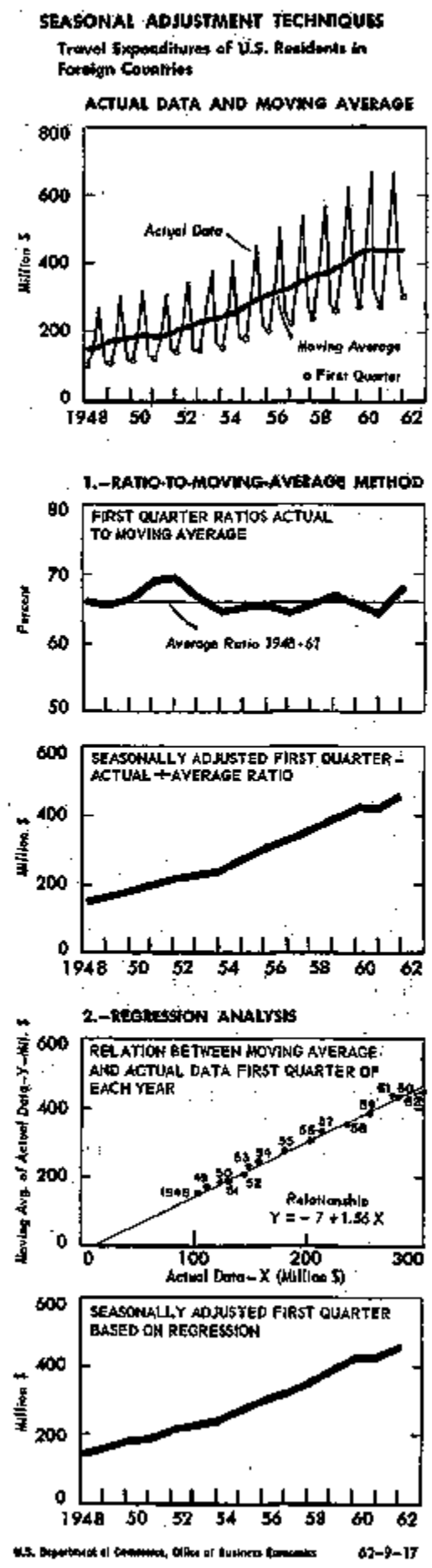
The use of seasonally adjusted basic economic series by government and private agencies as a guide to the current performance of the economy was referred to earlier in this article. Seasonally adjusted series also have important applications as a guide in business policy and operations.

First, by the use of seasonally adjusted information on such key series as sales, production and profits, a firm is able to appraise its actual performance from month to month or between any other two periods, unencumbered by the seasonal influences. This can be money saving at times, especially in an incipient reversal of the cycle. For example, by the use of seasonally adjusted series, some department store executives detected a weakness in sales as far back as July 1948 and took necessary actions with regard to their inventory policy, hiring, and so on, thus minimizing their losses during the 1948–49 downturn. But many factors must enter into such evaluations, and refinements of the raw data are necessary.

In other cases the seasonal pattern provides some help in gaging capacity requirements. This is of particular importance in an industry like electric power where sufficient capacity over short periods must be available to meet seasonal peak loads.

Second, seasonal factors have an important application in forecasting. Many firms must prepare their production and sales schedules well ahead on a monthly or quarterly basis. Raw materials must be purchased in sufficient amounts and with adequate inventory carryover. Advertising expenses must be allocated over the year; these are frequently based on a percentage of sales. Seasonal hiring and quotas for salesmen must likewise be planned ahead. A forecast of the sales anticipated month by month, or quarter by quarter, for the ensuing year usually

8. "Seasonal Adjustment on Electronic Computers"—Report of an international conference held in November 1960, sponsored by the OEEC and the Conference of European Statisticians.



U.S. Department of Commerce, Office of Business Economics 62-9-17

Effect of Shift in Date of Easter on Apparel Store Sales

(Percent of annual average)

	1957	1961
January	77	77
February	58	68
March	81	[1] 104
April	[2] 111	80
May	97	97
June	97	97
July	84	83
August	91	91
September	99	101
October	106	104
November	111	110
December	175	179

1. Easter date April 2.
2. Easter date April 21.

provides the necessary guide for making many of these operational decisions.

At least two approaches are available to obtain unadjusted monthly or quarterly forecasts. In the first, an annual forecast is decided upon by the utilization of any one of several available methods; often individual judgment adds the final touch in arriving at the "best" estimate for the year as a whole. The monthly or quarterly forecasts may then be derived by prorating the annual total in accordance with the seasonal pattern derived from the firm's past experience.

The second method is used when the forecasts rely on the firm's analysis of the factors influencing its quarterly or monthly fluctuations based on prior experience. In this approach the movement of seasonally adjusted data for the company is analyzed and quarterly or monthly forecasts are developed in seasonally adjusted terms. The seasonal factors applicable to the particular year are then used to convert the forecasts to unadjusted estimates for the months or quarters.

Some firms use seasonal patterns to guide them in stabilizing their operations over the year. More specifically, if a company is engaged in highly seasonal items, it may experience wide swings in employment, purchasing, and sales with costly and disturbing consequences. One method of overcoming this factor is to diversify operations by adding new lines with offsetting seasonals. For example, apparel stores that formerly carried men's wear exclusively have added women's wear lines. The spurt in these sales at Easter-time has helped to supplement their sales of men's clothing during this period. On the other hand, men's wear sales exhibit larger seasonal gains than women's in June and December. By adding women's apparel, therefore, some stores have been able to lessen the extent of the seasonal fluctuations in their aggregate sales.

Highly seasonal resort areas have attempted to overcome a similar problem by introducing new industries. Diversification is not always practical, however, and some manufacturers have overcome the problem of wide seasonal fluctuations by rescheduling production and by building up stocks in the "off-season" period, thus providing greater continuity in their operations.

Effects of moderating seasonals

Thus, while there has been some conscious effort on the part of firms to moderate their seasonals, the effect can be only limited in scope. As indicated earlier, seasonals arise from influences such as weather conditions and changes in consumer tastes, which are to a large extent not controllable. While increased efforts to lessen seasonal swings are desirable and have many worthwhile effects, such as providing more continuous employment to workers and stabilizing raw material purchases in seasonal industries, nevertheless their contribution to economic growth would apparently be small, as indicated by a study [9] recently released by the Committee for Economic Development.

9. It was estimated that if two-thirds of the seasonal fluctuations in nonfarm production could be eliminated in the next two decades the contribution of this factor alone to the long-term annual growth rate of 3 percent would amount to only one-tenth of one percent. "The Sources of Economic Growth in the United States," E. F. Denison, Supplementary Paper No. 13.

U. S. Direct Foreign Investments

(*Continued from p. 23*)

East, both foreign production by U.S. enterprises and exports from the United States rose by about 25 percent in the period. Exports to these areas are still larger than local production by United States-owned plants for most major commodities and include, of course, shipments financed by Government grants and credits.

Production by U.S. companies of these manufacturing commodities in Latin America has made considerable gains since 1957, increasing by $1 billion to a total of $2.4 billion. In the same period, exports from the United States have declined, so that local production in the area of such items as chemicals, electrical machinery, and transportation equipment now exceeds U.S. exports.

The comparative volumes of exports and local sales are influenced by many factors, including overall demand conditions in individual foreign markets, the degree of interchangeability between specific products, special foreign exchange or trading restrictions enforced in some countries, the technical conditions of production and shipment, and many others.